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ABSTRACT

This research study investigated the concern that too many women were dropping out of the Ph.D. program in chemistry and getting an M.S. degree. A major focus was on the differences and similarities in the reasoning between males and females who dropped out. The major source of data was focus group interviews involving 3 people in each of 2 interviews. The first interview consisted of females who decided not to continue in the Ph.D. program and stop with an M.S. degree and the second consisted of males who made the same decision. Surveys were also used as a method of triangulation. Results indicate that women were more likely than men to drop out of the chemistry Ph.D. program. The major difference between the men and the women was apparent in the percentage of students who changed from the Ph.D. track to the M.S. track. The women were also more likely overall to experience some sort of change in area of study, degree plan, or career plan. Major differences were found between the males and the females in the focus groups in the reaction they received from their family, friends, and advisors. Women were made to feel ashamed of their decisions while men were celebrated for their decisions to not go on for a Ph.D. Another difference was that issues about family and career were a big factor in the women's decisions. A similarity between the males and the females in the focus groups was that none of them had a good conception of what graduate school was like. They either followed the crowd to graduate school or went because it was expected of them. Contains 25 references. (JRH)

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A Qualitative Analysis of the Graduate Student Experience

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It is no secret that women are not adequately represented in the sciences. Women account for only 1/3 of the bachelor degrees in science, 1/4 of the advanced degrees and approximately 1/6 of employed scientists and engineers (Alper, 1993). Where in the pipeline are the women lost? Studies show that a large number of girls stop taking math and sciences courses in the middle school years (Raymond & Brett, 1993). Other studies show that women are lost to the sciences when choosing a major at the B.S. level (Dick & Rallis, 1991; OTA cited in Widnall, 1988). Still other studies have been done at the doctorate level (Berg & Ferber, 1983; Descutner & Thelen, 1989; Gunn & Sanford, 1988; Holmstrom & Holmstrom, 1974; Mooney, 1968; Naylor & Sanford, 1982; Ott, Markewich, & Ochsner, 1984; Widnall, 1988). These studies show that although women enter graduate school at the same rate as men, the graduation rate is not comparable - at least in the sciences.

However, these studies of graduate school attrition can't *explain* the loss of women from science and mathematics for several reasons. First, they examined the attrition rate of women in many departments, not just a single program, such as chemistry. Second, they were statistical studies that only looked at enrollment rates - causation can not be attributed to any variables. Holmstrom & Holmstrom (1974) was the only study that tried to relate variables to enrollment rates. This, too, was based on statistical analysis of variables such as marital status, academic employment, and family income. For our purposes, these

studies all had a fatal flaw, no one attempted to listen to the voices of the students about why they had dropped out of the PhD program. [Most studies define "dropping out" as not having successfully received a PhD degree.]

What variables affect a student's choice of continuing their graduate studies or dropping out? One area that has been studied as being important to student success in graduate school is the gender of their research advisor (Gilbert, 1985; Gilbert, Gallessich & Evans, 1983; Goldstein, 1979; Schroeder & Mynatt, 1993; Schuckman, 1987, Sugar & Tracy, 1989; Tidball, 1973). Gilbert, Gallessich & Evans (1983) found that women psychology graduate students with women advisors reported significantly higher self esteem, work commitment & career aspirations than women with male advisors.

Another area of that has been studied is faculty-student relations and their impact on student success (Hartnett, 1981; Hite, 1985). Hartnett (1981) found that in history departments, the female graduate students reported less emotional support than the males. Hite (1985) found in her study of 27 graduate departments that, regardless of their field, women perceived less support from their faculty members than did the men.

The presence of a mentor has also been shown to be important to graduate student success (Cronan-Hillix, Gensheimer, Cronan-Hillix & Davidson, 1986). Cronan-Hillix et al have shown in their study of psychology graduate students that the number of

publications and conference presentations is significantly related to whether or not the student had a mentor.

Role conflict is an important factor in female graduate student success (Beutell & Greenhaus, 1983; Hite, 1985). Beutell & Greenhaus (1983) found that married college student women experience conflict among their multiple roles. Hite found in her study of different graduate programs that men experienced more role congruence than did the women, regardless of their field of study. She proposes that this is one reason why women might decide to leave a doctoral program.

All of the work done to date on graduate student retention has been quantitative. Previous research has attempted to measure retention rates on large samples, which is useful because it shows general trends in retention. However, it tells us little, or nothing, about the people behind those rates - about why they made the decisions that they did. One way to find out more about the details involved in the decision-making process is to use a qualitative methodology, which would give us more depth and detail about a smaller segment of the population. In other words, we exchange quantity for quality.

In this study, the concern that too many of the wrong people were dropping out of the PhD program and getting a MS degree was investigated. A focus was put on the differences and similarities in the reasoning between males and females who dropped out. I hoped to gain some insight into this decision in order to offer possible solutions. I hoped to contribute to the knowledge in this

area in such a way that problem-solving programs and interventions could be formulated (Patton, 1990). The type of data collected to provide some insight into the area were the result of a survey instrument and focus group interviews.

The theoretical perspective that is used to focus this study is *phenomenology* which is a type of phenomenological research that focuses your research on answering the question: "What is the structure and essence of experience of this phenomenon for these people?" (Patton, 1990, p. 69). In this study, I was concerned with the essence of the experience the students had making the decision to drop out of the PhD program and get a MS degree instead.

Method

Focus Groups

The major source of data in this study was focus group interviews. The interviews involved a small number of people (3 people in each of 2 interviews) and a specific topic (in this case, why they decided to drop out of the PhD program with an MS degree). Both of the interviews were conducted with a homogeneous sample. The first interview consisted of females who decided to not continue in the PhD program and stop with a MS degree (Judy, Linda and Jennie), the second consisted of males who made the same decision (Sam, Aaron and Steve).

Patton (1990) notes several advantages to focus group interviews. He argues that they are a very efficient means of data collection, a means of focusing the discussion to the major points, and enjoyable to the participants.

In the focus group interviews done in this study, open ended questions were used in order to see the decision-making process from the eyes of the participants. I did not want to put words into their mouths or focus the discussion on what I thought *might* be important but actually wasn't important to the participants.

The focus group interviews were also conducted in an informal manner, i.e. no interview guides were used in order to leave the interview open to pursue whatever topic came up and seemed important in the participant's decision-making process. The questions asked all flowed from the discussion at hand, which permitted me to be highly responsive to the participants.

In order to collect the information necessary to offer possible solutions to the dropout problem, I chose individual students as the unit of analysis. The focus was, therefore, what happened *to the individual* in the graduate school setting that caused them to decide to get their MS degree instead of a PhD.

The sampling method used to determine which individuals would be interviewed was one of *homogeneous* sampling (Patton, 1990, p. 173), which is used to describe a particular type of group in detail. In this study, I wished to describe those people who decided to drop out of the PhD program and get an MS degree instead. So, my homogeneous sample consisted of only these types

of students. With this type of sample, focus group interviews are appropriate.

I chose to separate the focus groups into males and females because prior, informal discussion with other students who "dropped out" revealed there was a difference between the decisions of the males and the females. I also felt that the females would be more comfortable talking with other females and the same for the males.

Focus groups were chosen, as opposed to individual interviews, for several reasons. First, I felt the students would be more comfortable talking about this sensitive topic (because it *was* sensitive to them) along with others who were in the same situation. Second, I felt that they might trigger feelings, memories, or important details in each other.

These focus group discussions were each about an hour and a half long and were both video- and audiotaped. They were videotaped in order to record the body language of all the participants and also to serve as a backup to the audiotape. The body language became important because many times while one participant was talking, another would be nodding in support, which would not have been caught on audiotape. The discussions were audiotaped for ease of transcribing.

Triangulation of Data

In order to strengthen the study design, *data triangulation* was used. Data triangulation involves using different types of data in a study (Denzin, 1978). In this study, both a survey instrument and focus group interviews were used to provide a validity check. If similar patterns were found in the survey and the focus groups, the conclusions could be seen as more valid and not susceptible to the errors that occur when only one data source is used.

I felt that the triangulation of data was especially important in designing this study. With a study of this nature, it is difficult to remain totally objective. Based on my own experiences and the experiences of several of my friends, I had previous conceptions of why these people - especially the women - were leaving with an MS degree. In order to provide a check that my preconceptions did not influence the study results, I chose to do both a general survey and the focus group interviews.

Survey Instrument

In order to get general information about the chemistry graduate student population at a large, Midwestern university, a survey was distributed (See Table 1). This survey was open ended and, therefore, did not constrict how the students could respond. It included a section for demographic information, educational

background, research advisor information, and career path. In the cover letter, it informed the students that the results were anonymous and therefore they could write what they truly felt without worry of it "getting back to their advisor."

All 287 graduate students in the Department of Chemistry were given a survey via their mailboxes. Sixty-seven returned a completed survey (23%). The survey respondents were representative of the Department of Chemistry in terms of gender, division of study, and year of study. The comparisons can be seen in Tables 2 - 4.

Table 1 Questions Asked on General Survey

Sex M F
Division_____
Year 1st 2nd 3rd 4th 5th 6th _____
Marital Status _____ Occupation of Spouse _____

What degree did you plan to get when you applied for enrollment at [this graduate school]?

What were you planning to do with this degree?

What degree do you plan to get now?

What do you plan to do with your degree now?

If your degree objective changed, please write a description about why.

What undergraduate institution did you attend?

Is this a public or private institution?

How many students attend this institution?

What are the reasons you went into chemistry?

Why did you choose to go to graduate school?

How did you choose to come to [this graduate school]?

How did you choose a research advisor?

What is your relationship like with your research advisor?

If I were a 1st year student and wanted to enter your research group, explai like?

Before you came to Purdue, what did you think graduate school would be lik

In what ways were your expectations fulfilled?

In what ways were your expectations not fulfilled?

How do you rank yourself as a graduate student in relation to your peers? Why?

What is your perception of the difference between the jobs done by an MS and a PhD chemist?

Table 2 Department and Survey Gender Statistics

Gender	Department	Survey
Males	68%	60%
Females	32%	40%

Table 3 Department and Survey Division of Study Statistics

Division	Department	Survey
Organic	31%	12%
Analytical	30%	27%
Inorganic	13%	19%
Chemical Education	5%	10%
Biochemistry	12%	12%
Physical	9%	7%
Science Education	a	3%
Chemical Physics	a	1%
Unspecified	-	7%

[a] These are areas that are multidisciplinary and are not solely in the Department of Chemistry

Table 4 Department and Survey Year of Study Statistics

Year of Study	Department	Survey
1	27%	24%
2	20%	21%
3	18%	22%
4	21%	25%
5	7%	4%
6	3%	3%
other	4%	0%

The data were recorded on an Excel 4.0 Spreadsheet in order to facilitate the sorting of the data by gender. In recording the data, the responses were kept as close to the original as possible. However, in order to effectively enter the responses into the spreadsheet, some responses had to be paraphrased.

The responses to the survey were sorted based on the gender of the respondent to see if any gender-related patterns existed in educational background, research advisor information, and career path of the respondents.

Results

The general survey of graduate students in chemistry support what is found in the literature. It shows that women were more likely than men to "drop out" of the chemistry PhD program. The major difference between the men and the women was apparent in the percentage of students who changed from the PhD track to the MS track. Women were more than twice as likely to "drop down" than men (18.5% vs. 7.5%, respectively). The women were also more likely overall to experience some sort of change (whether it be change in area of study, degree plan, or career plan) than the men (52% vs. 32.5%, respectively). This is an important and discouraging result.

Similarities and differences were found in the decision making process for the males and the females in the focus groups.

The major difference between the males and the females was the reaction they received from their family, friends, and advisors. The females were made to feel ashamed of their decision. They had to defend their decision. This is best illustrated by Judy's discussion of people's reaction to her decision to just get a MS degree and not go on for a PhD. Judy says about her mother's reaction:

> Um, and I fought with it for awhile because, you know, my parents, at least my mother was really upset. Oh, you know, "It's because you're a woman and, uh, you're letting yourself down. You're smart enough to do it. Why do you want to leave?"

She also discusses her undergraduate professors' response in the following paragraph:

> And when I started telling people, even my professors back at my undergrad, they are like, "What's wrong? What happened to you. You had so much promise." Um, you know, when I made my decision, that was it. But I still felt that these people were trying to pull me the other way. "You know, you're wasting yourself with a masters."

However the men of the focus group were celebrated in their decision. It seemed like the men had a huge weight lifted from

their shoulders when they made their decision, because now they finally knew what they really wanted to do with their life. Sam's discussion of the reaction he received supports this. Steve had this to say about the time he heard that Sam had decided to get a MS degree.

> And I thought ... well actually in my mind I was thinking, WOW, he knows exactly what he wants to do with his life instead of following like a flock of sheep ... So, I was actually quite impressed that people knew exactly what they wanted to do ... and did it.

Sam's professors also supported him. He explained their reaction to his decision:

> [My analytical major professor] was very supportive. Like when I talked to him ... it was ... that was ... one of the hardest things I ever had to do. He said, "OK. I'm glad you've decided. You've thought about this and you know what you want to do." And that was kinda the reaction ... that most people had. "Good, you've decided something. You're running with it." And they thought it was a good decision ... I thought I'd get more flack ... for the decision than I've gotten. I've almost been waiting for it ... kinda, I'm not sure, masochistically, like, hoping that somebody would, like, give me problems. I don't know why. [Laughter]

After pressing the issue, Sam had this to say:

I: So did anybody make you feel that there was some lost potential there ... that, 'Oh, what happened? You were doing so well. Why did you decide to settle for a Masters?"

Sam: I've had nobody come up to me and ... in an angry tone of voice say, "It's a waste of your talent." Nobody has ever said that to me. Ever.

Another major difference between the males and the females in the focus groups was that the women talked at length about how it would be easier to have a family and a career since they chose to get an MS degree as opposed to the PhD. This seemed to be a big factor in their decision. Linda discussed how having a family would change her career goals. When she had a family, Linda wanted, like Judy, to start working part time. She said:

Um, in my case, I originally, when I came here, I thought I wanted to get the PhD and I wanted to work in research, you know, in industry, for awhile, you know, like five or six years or something. And then if I actually found somebody that I wanted to get married to and then have some kids with, then at that point I was thinking I wanted to go and do something like patent searching of chemical compounds on a

> consulting basis for, um, companies because I have a friend who does that and it works out really well because she can do it out of her own house and she can work, you know, part time ... however many hours she wants. And she's still in the house where the kids are.

Linda also felt that getting a Masters job would make it easier to move around and follow her spouse-to-be around the country. She said:

> The thing is, it's a lot easier to get a Masters job, also. [Laughter] You're much more relocatable. You can move around the country much more easily. Which, you know, um, I mean, if you think you ever want to get married, it's something to think about. Especially if you're gonna get married to someone who has a PhD.

The men, however, did not consider family issues at all in their decision. When the topic was brought up in the interview (by the interviewer), they basically shook their shoulders at the question and said it did not apply to them. When asked if marriage-career conflict entered into his decision at all, Aaron said that it hadn't. He had the following to say:

I: Um. OK, to switch topics a little bit, I guess. Do, any of you anticipate any, uh, marriage-career conflicts? ... I mean, did that ... did you think about ... did that affect your decision at all. Thinking, ohh, it will be easier to have a family if I get a Masters.

Aaron: Not really. That's ... I think ... in reality that may ... that may happen ... Um, but as far as thinking about that when I made my decision, no. That didn't enter into the picture at all.

If any of the males had considered the possibility of marriage-career conflict, it should have been Aaron, considering he was going to be married soon. He admitted that upon reflecting on the idea, that it's probably true that he would have more time for his family as a high school teacher than as a PhD chemist. But he had never thought about it prior to that point in time.

Considering family/career conflicts should have been no more urgent to the women than the men. Two of the three participants in each group were not married or engaged (at the time). However, the women seemed to be thinking into the future and realized that they were going to be the primary caregiver to their children (and their husbands!) and that getting a MS degree would minimize the role conflict they experienced.

Role conflict had already begun to be a problem for the women of the survey. Jennie best described this when she

explained how she was tired of being in school. She got burned out very quickly which she attributes to the fact that she had too many roles to fill. Jennie said:

> Um, we might have all said it at one point. About how we're just tired of being here. I ... I have always looked at this ... comparing myself to ...almost all of my very close friends are male ... Um, but I burned out way before they did. And I kept trying to figure out why. And I know why at this point. At least I'm convinced I know why. Um, I worry about so many things. I mean, I'm here being a graduate student and I feel a responsibility towards teaching. Um, I have a responsibility to myself towards my coursework. I have a responsibility to [my professor] to do, you know, whatever for him. Um, I'm worrying about relationships. I'm worrying about money. It's like I try to juggle all these things and I get so involved that I burned out right away.

Role conflict did not seem to be a problem for the men. They did not bring up this issue in the discussion. When the interviewer brought this issue up, Sam had the following to say:

> I: Do you feel like you had too many things to worry about? Like your classes, your research, uh, your social life. All of these things.

Sam: All of those were fine. It was just the fact that I didn't enjoy it. They were all going well. I just didn't want to do it.

Another important result of the focus group interviews was that women were disconcerted by the fact that they were no longer the best and the brightest. For them, this was the first time that this happened. This affected their decision to get the MS degree because they felt like "failures" for the first time. Jennie discussed how she felt a loss of confidence when she came to graduate school and was no longer the number one student. This contributed to her decision to get the MS degree.

"I experienced for awhile there a real loss of confidence when I came here because I had gone from being number one to, holy cow, the biggest brains in the world are all around me all of a sudden. And that didn't help the whole situation either.

For the men, it either didn't bother them that they were no longer number one or they felt they were still among the best and the brightest. The general survey results would support the latter. The survey respondents were asked to rank themselves in relationship to their peers. All of the responses could be categorized as follows: (a) above average, (b) average, (c) below average. The results can be found in Table 5. In accordance with

the literature, the females ranked themselves lower than the males (Arnold, 1987). In fact, several of the males wrote they were number one, while none of the females did.

Table 5 Survey Respondents' Self-Ranking

Self-Ranking	Females	Males
Above Average	35%	50%
Average	54%	39%
Below Average	11%	11%

A similarity between the males and the females in the focus group was that none of them had a good conception of what graduate school was like. They either followed the crowd to graduate school or did what was expected of them and went to graduate school.

When discussing her ideas about what graduate school would be like, Judy admits that she decided to go to graduate school before she knew what it was like. It seemed like Judy was pressured by (or at least it was assumed by) her parents and her undergraduate professors that she would attend graduate school. Judy said:

> It was assumed from the day I was born that whatever I went into I was gonna get the highest degree I could because

> my parents were smart, I was smart and that's what you do. [M]y professors in undergrad ... were like, "Grad school would be great for you. It's just what you want. You know, you just sit there and do research and that kind of thing and go on and do that. And of course that's what you're going to do."

A very similar story was told by the other females and all of the males. Steve says he didn't have a good idea of what graduate school was like. He was just following the crowd to graduate school. Steve said:

> WOW, he knows exactly what he [referring to Sam] wants to do with his life instead of following like a flock of sheep. You know, that's ... I feel like, you know, a lot of people are just following the crowd. You get to the point where, oh, OK, I have to do this next. I'm probably still following the crowd slightly.

This is supported by the general survey results. Lack of knowledge of what graduate school was like was common to the general survey respondents also. A significant number of respondents had no idea what to expect from graduate school (26% of the females and 20% of the males).

Possible Solutions

The purpose of this research was to investigate the factors that played a role in the focus group participants' decisions to get an MS degree instead of a PhD. Several of the important factors were brought out in the focus group interviews: balancing family and career, preconceptions of graduate school, role conflict, and self-esteem. These are areas that warrant further research.

One could speculate on possible "solutions" to the "problem". One solution would be to discuss what types of jobs that PhD vs. MS degree students could get. Several guest speakers could come to the graduate school and talk about what they do. That way, students could get a better idea of what the future would be like and then they could make an informed decision about what degree they sought. However, this presupposes the fact that the department would be willing to have more MS students, which generally is not the case.

Another possible solution is that at the *undergraduate* level, this same process occurs so that the students could make an informed decision *before* they decided to come to graduate school.

One way to make it easier on the students who do decide to get their MS degree, is to not attach such a negative feeling with getting a MS degree. Presently it is thought of as a consolation prize to those who were not good enough to get their PhD.

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